

UNIVERSITY OF PENNSYLVANIA

AN ANALYSIS OF SOUNDS AND
FREQUENCY WORDS BASIC
TO A NEW METHOD OF
CORRECTIVE SPEECH

(A PRESENTATION OF ORTHENIC MATERIAL DEVELOPED FROM
THE POSTULATES OF TWITMYER)

YALE S. NATHANSON

A THESIS
IN PSYCHOLOGY

PRESENTED TO THE FACULTY OF THE GRADUATE SCHOOL IN
PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY

PHILADELPHIA

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TO PROFESSOR EDWIN BURKETT TWITMYER

In Grateful Acknowledgment
of a Complete Indebtedness



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POSTULATES OF TWITMYER)¹

By

YALE S. NATHANSON
University of Pennsylvania

I—INTRODUCTION

It is a clinical dictum that a diagnosis should be also a prognosis.² It follows then that every thorough diagnosis must include etiology and the complete diagnosis must indicate therapy.

Many of the existing systems of speech diagnosis offer excellent basis for academic discussion and even for an experimental approach to an understanding of the etiological factors but present no therapeutic material for effecting amelioration. It has been our experience, in pathological and non-pathological cases, that the removal of the immediate cause of the speech defect does not mean of itself rehabilitation of the speech processes. Cases in point are: first, a case of paresis (pathological) arrested by specific treatment; second, a sub-breather (non-pathological), whose breathing was restored to normality by proper exercises; third, a case of marked malocclusion (anatomical anomaly) corrected by orthodontic appliances; fourth, a case of cleft palate (anatomical anomaly) corrected surgically; fifth, a case of negativism, absence of overt speech in which proper psychological methods were employed to effect conformity; cases of deafness, neurological conditions, hysterias, diseased or enlarged tonsils, maxillary fractures, blockages of nasal pharyngeal passage.³

¹ TWITMYER, EDWIN BURKETT, Professor of Psychology, Director of Speech Clinic, Assistant Director The Psychological Laboratory and Clinic, University of Pennsylvania.

² Elegantly stated "Every diagnosis is a prophetic utterance—a prognosis," WITMER, LIGHTNER, Professor of Psychology, Director The Psychological Laboratory and Clinic, University of Pennsylvania.

³ Cases referred to are from the University of Pennsylvania Speech Clinic.

In all these cases, even after the correction of the immediate cause of the speech defect had been effected, the defects of articulation persisted. The real *desiderata*, as the consideration of the Orthenist, is appropriate diagnostic material to employ in effecting speech restoration. In fact, in many cases where surgical methods, though indicated, are not utilized, or when a malocclusion is not corrected, if suitable diagnostic teaching is employed certain substitutions by other musculatures are made and there results improvement or complete speech correction.

It is not to be thought that the diagnostician and Orthenist is not interested in etiology. In the past two centuries the most phantastic explanations and curative methods for speech defects have been formulated.⁴ We might mention the methods of lingual surgery as one extreme and the theory of changed handedness as the other. Hypnotism, prostheses of all descriptions, psychoanalysis,⁵ visualization of speech mechanism,⁶ employment of surrogate imagery, cerebral dominance, every possible explanation has been advanced, exhausted and rejected, each as the sole etiological factor and each implying one positive therapeutic method.

II—METHODS OF APPROACH

Twitmyer after many years of clinical experience realized that the solution of the problem of speech defects necessitated, first, restoring the individual's bodily processes to normality and subsequently employing material designed to develop the processes of articulation.

Accordingly, exhaustive observations were made of cases. Twitmyer then outlined and directed a series of physiological and bio-chemical studies. Saliva,⁷ urine,⁸ alveolar carbon dioxide,⁹ and hemato-respiratory processes,¹⁰ were the subjects of research. Other notable work was performed on laryngeal action¹¹ and

⁴ BLUEMEL, C. S., *Stammering and Cognate Defects of Speech*, Vol. I and II, New York, 1913, G. E. Stechert and Company.

⁵ APPELT, ALFRED, *Stammering and Its Permanent Cure*, London, 1920, Methuen and Company, Ltd.

⁶ KENYON, ELMER L., Action and Control of the Peripheral Organs of Speech, *J. Amer. Med. Ass.*, 1928, 91, 1341-1346.

⁷ STARR, HENRY E., Studies of Human Mixed Saliva, *J. Biol. Chem.*, 1922, 54, No. 1.

STARR, HENRY E., The H-ion Concentration of Mixed Saliva Considered as an Index of Fatigue and of Emotional Excitation and Applied to a Study of the Metabolic Etiology of Stammering, *Amer. J. Psychol.*, 1922, 33, 394-418.

⁸ STRATTON, LEON DUPRE, A Factor in the Etiology of a Sub-Breathing Stammerer, *J. Compar. Psychol.*, June, 1924, 4.

⁹ STARR, HENRY E., Concomitants of High Alveolar Carbon Dioxide, *Psychol. Clinic.*, 1928.

¹⁰ TRUMPER, MAX, *A Hemato-Respiratory Study of 101 Consecutive Cases of Stammering*. Thesis, Graduate School, University of Pennsylvania, 1928.

¹¹ KENYON, ELMER, L., Relation of Oral Articulative Movements of Speech and of Extrinsic Laryngeal Musculature in General to Function of Vocal Cord, *Arch. Otolaryngol.*, 1927, 5, 481-501.

neurological factors.¹² The matter of general health¹³ was studied, elimination, periods of rest, nervous stability, and imaginal type.¹⁴ There were utilized from the psychological approach the principles of conditioning,¹⁵ the causative consciousness factors of habit,¹⁶ and functionally the matter of synchronization of diaphragmatic and intercostal musculature.¹⁷

PSYCHOLOGICAL APPROACH TO PROBLEM

However, the purely psychological aspects of speech received the greatest attention. There is no phase of applied psychology in which cognizance must be had of more psychological factors than in Orthenics. Personality, evaluations, a recognition of individual differences, sensory acuities, muscular coordinations, mental functioning, instinct, reflexes, imagery, must all be computed in the equation on which a prognosis is predicated. And then the therapeutic material to be utilized, the *modus operandi* with each case, an entity of itself, above all requires psychology.

To comprehend with any degree of fullness, speech output, each departure in speech was studied and an attempt made to assign a causal correlative in process. Extensive and intensive observations of specific defects permitted a determination of what normal speech really is. This was the origin in method of the basic postulates of Twitmyer.

"All higher symbolic thinking, all abstraction and ideation, use language symbolism as a necessary tool, and language is essentially a social function."¹⁸ If two children, at birth, were left on an uninhabited island and grew to adult life, there is nothing in our present knowledge of the unfolding of instinctive behavior to indicate that they would ever develop graphic language, but, on the basis of our clinical observations of primitive and artificial language, it seems likely that they would formulate between them a mode of spoken language.¹⁹

¹² WEST, ROBERT, A Neurological Test for Stutterers, *J. Psycho-path.*, 1929, 10, 38-114.

¹³ Records kept at the University of Pennsylvania Speech Clinic.

¹⁴ FERNBERGER, SAMUEL WEILLER, Possible Effects of the Imaginal Type of the Subject on Aphasic Disturbances, *Amer. J. Psychol.*, 1919, 30, 327-336.

¹⁵ TWITMYER, EDWIN B., *A Study of the Knee Jerk*, Philadelphia, 1902, The John C. Winston Company.

¹⁶ NATHANSON, YALE SAMUEL, A 'Conceptual' Basis of Habit Modification, *J. Appl. Psychol.*, 1929, 13, 468-485.

¹⁷ JELLIFFE, SMITH ELY, Postencephalitic Respiratory Disorders, *J. Nerv. and Ment. Dis.*, 1926, 64, 157-166. (A study of breathing and records made by Professor Twitmyer.)

¹⁸ HERRICK, C. JUDSON, *Brains of Rats and Men*, Chicago, Ill., 1926, University of Chicago Press, p. 21.

¹⁹ WUNDT, WILHELM, "Speech" *Readings in General Psychology*, ROBINSON and ROBINSON, Chicago, 1923, University of Chicago Press, p. 375, from *Outlines of Psychology* (3d ed.), pp. 339-43. (Translated by Charles H. Judd) Leipzig: Alfred Kröner Verlag, 1907.

Animals likewise produce significant sounds. The difference between animal and human language is rather one of motivation and symbolism. The animal probably employs sound to apprise his fellow creatures of danger, hunger, thirst and sex while the human being is distinctive in that he is the only one of the entire animal kingdom who uses language as an instrument of social intercourse, for the exchange of ideas, which affords him the verbal satisfaction coming on the heels of the satisfying of his gregarious instincts.

Our approach to the restoration or correction of defective speech is determined by our psychological system. If one discards consciousness as a factor, one method follows; while if one thinks in terms of a causative or directive consciousness another procedure becomes operative.

It is our thesis that speech correction is dependent upon the systematic development of the three basic steps of normal speech. First, that of correct breathing and the subsequent proper utilization of breath; second, the correct kinaesthetic or muscular imagery involved in speech which we designate as oral position or Oratans; third, the combination of these two, to effect a normal output of speech. The resultant of these three steps, the production of oral expression, is predicated on the assumption that the individual is possessed of integrated mental processes and endowed with a normal instinctive urge for speech.

III—SPECIFIC PROBLEM

Twitmyer later directed his attention to the formulation of material appropriate to the needs of his postulates of speech. The elaboration of this original interest constitutes the problem of the present thesis. Speech as we employ it in the expression of thought processes draws for its motivation or urge on instinctive processes—"an *a priori* synthesis" (James).

Speech consists of words which in turn are sounds in combination. Any natural system of pedagogy and more especially the methods of diagnostic teaching make it necessary that the sounds of speech and finally the words themselves be progressively allocated, so that no word is introduced at any stage in the developmental process for which the correct Oratans has not been presented and learned. No system extant has been developed which is thus scientifically correct. Numerous presentations have been made attempting to observe fine gradations of complexity and difficulty but all have fallen into the serious error of introducing, for the sake of content, elemental sounds, not at that stage of the training program, a part of the individual's functioning equipment.

IV—PROPOSED CLASSIFICATION

It became therefore immediately necessary to propose a new classification of the sounds of speech apart from tradition and from philology. The usual academic distinction and definitions of 'vowels' and 'consonants' formulated by Herrman, Fourier, Willis, Helmholtz,²⁰ *et al*, we shall purposely avoid discussing. Many investigators have indicated there are two kinds of breath used in speech, first that which passes unmodified through the larynx just as in mere breathing, secondly that which is modified by vibrations of the vocal cords. It has been held that the former is employed in the production of 'consonants' while the latter type of breath passes out through the mouth as a 'vocal'. Other modifications of sounds such as those passing through the nose result in 'nasals'.²¹ However, we do not feel that such classification is basic or necessary to our method.

Our major concern is with the question of a disposable column of air, the modification made upon it by the larynx or by the peripheral organs of speech. The dichotomous classification which follows meets our requirements:

First: *LIBAERS*: Those sounds in articulation which result from the breath passing through the larynx uninterrupted by face, tongue, or teeth; and secondly: *MUTAERS*: Those sounds which are interrupted and modified by tongue, face or teeth.

It is in one or both of these processes in which the speech difficulties reside. Therefore we begin our learning or relearning process, introducing it to the individual as a phenomenon *de novo*, instituting it as a series of new musculature acquisitions. The learning process whether in a motor or in an intellectual series is one of habit formation, in setting up and establishing of new synaptic connections marking the path of preferred neural conductance between the stimulus and the organism's response.

Under normal conditions the learning process and the habits upon which it is dependent are in part 'set up' by the life experience of the individual. The successful system of Orthenics must take this fact into serious account and in substituting new method must prepare the individual for a gradual adaptation. The new habit development is made possible by this material because the corrective technique follows a plan of natural function. The transfer from one sound to the complexities of the next and the position of the tongue, cheeks, lips, etc., follow the natural sequence of rehabilitation.

This classification adopted by us emerged primarily from extensive teaching experience in the clinic. Based on what we

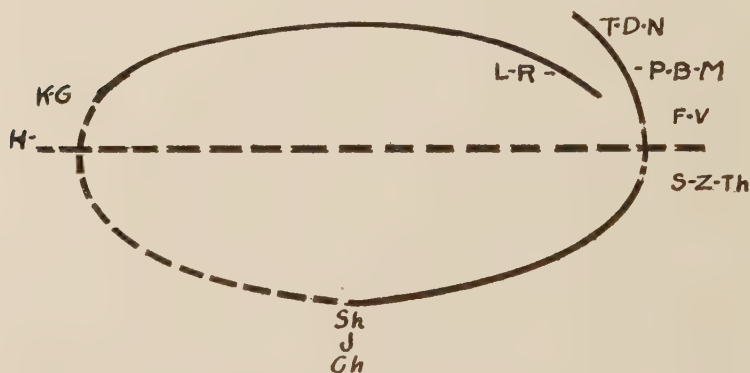
²⁰ RUSSELE, G. OSCAR, *The Vowel*, Columbus, 1928, Ohio State University Press.

²¹ KING, SAMUEL ARTHUR, *Graduated Exercises in Articulation*, Boston, 1910, Small, Maynard and Company.

thought was a combination of facility of expression and pedagogical methods superimposed on anatomical correlatives we formulated the 'Curve of Articulation'²² which subsequently became the basis of our classification. The T-D-N Group (I) involves the use of the tongue against the upper teeth. The P-B-M Group (II) is made by the movement (compression) of the lips, while F-V Group (III) is formed by the upper teeth in contact with the lower lip.

The S-Z-Th Group (IV) begins a new series of articulatory function, the proximation of the teeth; Sh-J-Ch Group (V) is a furtherance of this action by the closure of the jaws.

The K-G Group (VI) utilizing the posterior arching of the tongue and the L-R Group (VII) the anterior position of the tongue completes the series. The Profans H Group (VIII) is indicated on the basis of the origin of the sound. In a sense the



CURVE OF ARTICULATION

Curve of articulation seems like a purely schematic and 'conceptual' presentation. It is 'conceptual' and schematic in one sense but lends itself to a satisfactory explanation in terms of anatomical correlatives which proved valid statistically as well as theoretically (as shown later by an analysis of the frequency words.)

We are aware of the fact that finer discriminations are possible but basically our analysis serves the purpose for corrective speech.

The two major groupings originally made were:

First: LIBAERS, those sounds in articulation which result from the breath passing through the larynx uninterrupted by face, tongue, teeth.

²² The 'Curve of Articulation' is based upon the work of the writer in collaboration with Professor Twitmyer.

Second: MUTAERS, those sounds which are made by interruption and modification of tongue, face, teeth.

In the first group we have the basic sounds, A, E, I, O, U upon which the many variations and shadings may be superimposed. The second grouping lends itself to a further analysis into eight orders:

Group One: The sounds which occur in this group are designated, LINGUADENS, the sound being the result of combination of position of tongue and teeth. In this group appear the sounds of T, D, N.

Group Two: This group is designated as the LABRIENS, in which the lips are utilized as the agents of interrupting and modifying the breath to effect sound. In this group appear the sounds, P, B, M.

Group Three: This group is designated as the LABRIDENS, the sounds of F, V appearing in this group are made of modifications effected by the teeth and lips.

Group Four: The sounds of this group are designated DEN-SANTS, the sounds being S, Z, TH made by the occlusion of the front teeth.

Group Five: This group includes the sounds of SH, (soft) J, CH made by the closing of the jaws, hence designated as MAXILLAENS.

Group Six: This group is designated as LINGUADORS, the posterior part of the tongue being utilized in effecting the sound. These sounds are K, G, including also NG which is not a combination of N and G but is in itself an entity of articulation.

Group Seven: This group in contrast with the preceding group, which utilizes the posterior part of the tongue is concerned with a function of the anterior part of the tongue and is designated as LINGUANTS, the sounds L, R.

Group Eight: This group is used to designate the sound H as the 'breathing out' and is designated, PROFLANS.

Much academic discussion is to be found on the classification of WH and Y. Many text books and some perhaps with a slight degree of claim insist that these are 'consonants' (Mutaers), at least in a small percentage of instances. For our purpose we do not feel that it is necessary to make such classification because in actual speech the WH is a combination of the OO sound with what follows; the Y likewise takes on the character of the subsequent 'vowel' (Libaers) by merging with it from the EE position (Oratans One).

The H sound, Proflans, is also a controversial point in sound classification. We have admitted it as Group Eight under the

general head, Mutaers. In many respects it really is one of the Libaers because of its production as the breath column unmodified by the peripheral speech organs. On the other hand, it is not a true case of Libaers because it is not subject to Laryngeal modification.

It seems equally appropriate to classify the Profans either way. It is our opinion that at this point it is more convenient and expedient to classify it as one of the Mutaer group and it has been thus regarded.

On the basis of these classifications there was mathematically determined the various combinations of sound so that the individual being given corrective speech work need not at anytime be forced to practice or say sounds of any group which he had not yet been taught, nor to omit any possible sound.

V—SOUND GROUPINGS

Thus we introduce each group progressively and then combine groups and partial groups, e. g. we may combine

1-1 (T) with the five basic Libaers

1-2 (D) with the five basic Libaers

1-3 (N) with the five basic Libaers

then 1-1, 1-2, 1-3 with each other in any of the five Libaer order. Groupings may then be made in one, two, three, four or five order combinations, e. g. I-1; II-3; III-2; IV-1; VII-2, etc., with any selection of Libaers.

By employing the Formulae of Combinations

$$C n, r = \frac{n!}{(n-r)! r!}$$

a completeness is assured which would account, not only for every word in the English language but a method, which with minor adaptations would be applicable to any of the languages of the Indo-European group.

The combinations in the various groupings could be most advantageously presented schematically by charts.

In addition to this type of training it is necessary to allow for quick changes in Oratans when Mutaers appear in sequence without the intervention of Libaers. This difficulty usually is relieved by the acquisition of the progressive Groups but where any confusion persists, specific drill is not contra-indicated.

The following combined sounds by Groups are to be introduced in their appropriate order:

Combinations	Groups	Combinations	Groups
BL	II-VII	PL	II-VII
BR	II-VII	PR	II-VII
DR	I-VII	RD	I-VII
FL	III-VII	RF	III-VII
FR	III-VII	RL	VII
GL	VI-VII	RB	II-VII
GR	VI-VII	RK	VI-VII
KL	VI-VII	RG	VI-VII
KR	VI-VII	RP	II-VII
LF	III-VII	RT	I-VII
LJ	V-VII	SN	I-IV
LP	II-VII	SM	II-IV
LK	VI-VIII	SCR	IV-VI-VII
LB	II-VII	STR	I-IV-VII
LD	I-VII	ST	I-IV
MT	I-II	SP	II-IV
NG	I-VI	SL	IV-VII
ND	I	SK	IV-VI
NT	I	TR	I-VII
NK	I-VI	X	IV-VI
NCH	I-V		

(The plurals may be formed of these by adding 'S' or 'ES' or 'Z' (sound) provided the Group Four has previously been introduced.)

The articulation of elemental sounds is thus accomplished. The final teleological product, speech, means however, integrated word formation. This is essentially the prescription written into Twitmyer's third postulate. An obvious problem arises, first, the necessity for gradation of words consistent with the complexity-arrangement limited by the 'Curve of Articulation'; secondly, if there is to be derived a 'transfer' of usefulness, the selection of words is of paramount significance.

VI—SOURCES OF MATERIAL

Accordingly it was determined to make a selective accumulation of frequency words. A survey of existing studies was prosecuted, minor changes empirically but deemed necessary, were made, and there resulted a list of five thousand, one hundred thirty-eight (5,138) 'Frequency Words'.

The present list was obtained from the following sources:

The Individual Study of the Spoken Vocabulary of Eighty Children from One to Six Years of Age, by Ernest Horn.²³

Two Hundred Thousand Running Words of the Spoken Vocabulary of Kindergarten Children, by Mrs. Ernest Horn.²³

The Tabulations of Seventy Thousand Running Words of the Spoken Vocabulary of First Grade Children, by P. C. Packer.²³

An Analysis of Thirty-Seven Primers, by H. W. Kircher.²³

²³ Report of the National Committee on Reading, Part I, *Twenty-fourth Year Book of the National Society for the Study of Education*, 1925, Guy Montrose Whipple, Editor.

An Analysis of the Vocabularies of Ten Second Year Readers, by E. T. Hough.²³

A Critical Analysis of the Vocabulary of Ten Third Grade Readers, by N. S. Miller.²³

The Vocabularies of Ten First Grade Readers, by J. L. Packer.²⁴

being an analysis of the vocabularies of ten first grade readers from the following series:

- | | |
|----------------------|-----------------|
| 1—Aldine | 6—Heath |
| 2—Beacon | 7—New Education |
| 3—Brooks | 8—New National |
| 4—Carroll and Brooks | 9—Riverside |
| 5—Cyr | 10—Wheeler |

(From this study Three Thousand, Five Hundred Forty-One (3,541) different words resulted.)

*The Child Study Committee of The International Kindergarten Union*²⁵ selected a list of Two Thousand Five Hundred Ninety-Six (2,596) words from three sources:

- 1—Words children used while attending kindergarten
- 2—Words children used while stimulated by pictures
- 3—Words children used while in the home.

The Teacher's Word Book, by Edward L. Thorndike.²⁶

(An alphabetical list of 10,000 words which are found to occur most widely in a count of 625,000 words from literature for children about 3,000,000 words from the Bible and English classics; about 300,000 words from Elementary-School text books; about 50,000 words from books about cooking, sewing, farming, the trades, and the like; about 90,000 words from the daily newspapers; and about 500,000 words from correspondence.) Forty-one sources were used.

Words Used for Individual Speech Records, by Sara M. Stinchfield.²⁷

An Investigation of the Development of the Sentence and the Extent of the Vocabulary in Young Children, by Madorah Elizabeth Smith.²⁸

A List of Fifteen Hundred (1,500) Words Selected to be Suitable for Use in All Forms of Reading Material in Grades One, Two and Three, by Arthur I. Gates.²⁹

²⁴ PACKER, J. L., *The Vocabulary of Ten First Readers*, Chapter 9, *Twentieth Year Book of the National Society for the Study of Education*, Part II, 1921.

²⁵ Report of the Child Study Committee of the International Kindergarten Union, *A Study of the Vocabulary of Children Before Entering the First Grade*, Washington, D. C., 1928.

²⁶ THORNDIKE, EDWARD L., *The Teacher's Word Book*, New York, 1921, Columbia University Press.

²⁷ STINCHFIELD, SARA M., *A Preliminary Study of Corrective Speech*, University of Iowa Studies in Child Welfare, Vol. 1, No. 3, First Series No. 39, December 15, 1920.

²⁸ SMITH, MADORAH ELIZABETH, *An Investigation of the Development of the Sentence and the Extent of Vocabulary in Young Children*, University of Iowa Studies in Child Welfare, Vol. 3, No. 5, First Series, No. 109, May 15, 1926.

²⁹ GATES, ARTHUR I., *A Reading Vocabulary for the Primary Grades*, New York, 1926, Columbia University Press.

The words were originally selected from the following sources:

1. The 2,500 words of highest frequency, as determined by Thorndike's count of Four and a Half Million words, of which approximately fourteen per cent. were words from children's literature.

2. Any words not in the 2,500 from Thorndike found in the thousand words of highest frequency as determined by a count of words in a selection of young children's literature.

3. All additional words found in the thousand most frequent words in a series of readers for Primary Grades.

4. All additional words found in the thousand most frequent words in the spoken vocabulary of young children.

The Relative Frequency of English Speech Sounds, by Godfrey Dewey.⁸⁰

(A selective study of 100,000 words representative of written, spoken and printed English of today) The material analyzed consisted of the following sources:

15% newspaper editorial English	
New York Tribune.....	5000
Boston Evening Transcript.....	5000
Los Angeles Daily Times	5000
15% newspaper news English	
Chicago Daily Tribune.....	5000
Kansas City Star.....	5000
Atlanta Constitution.....	5000
15% modern fiction	
5% novel	
Winston Churchill (<i>The Crisis</i>).....	2500
William Allen White (<i>A Certain Rich Man</i>).....	2500
5% short story	
Rudyard Kipling (<i>The Day's Work</i>).....	2500
Mark Twain (<i>The American Claimant</i> , etc.).....	2500
5% drama	
William Dean Howells (<i>The Mousetrap</i> , etc.).....	2500
Clyde Fitch (<i>The Stubbornness of Geraldine</i>).....	2500
10% modern American speeches	
Abraham Lincoln.....	5000
Theodore Roosevelt.....	2500
Woodrow Wilson.....	2500
5% personal correspondence	
Richard Harding Davis.....	2500
Robert Louis Stevenson.....	2500
5% business correspondence	
Five manuals of typewriting, business English and short-hand, 1000 words each.....	5000
5% modern advertising	
19 advertisements representing leading advertisers, mediums and agencies.....	5000
5% religious English	
Holy Bible (St. Mark 1:1).....	1000
Henry Ward Beecher (<i>Sermons</i>).....	1000

⁸⁰ DEWEY, GODFREY, *Relative Frequency of English Speech Sounds*, Cambridge, 1923, Harvard University Press.

Phillips Brooks (Sermons).....	1000
Christian Herald (editorial).....	1000
Catholic News (editorial).....	1000
5% (popular) scientific English	
Scientific American.....	3000
Science	1000
Popular Mechanics	1000
5% modern 'special articles'	
Literary Digest.....	1000
American Magazine (2).....	2000
Outlook	1000
Independent	1000
5% magazine editorial English	
Independent	1000
Atlantic Monthly.....	1000
New Republic	1000
Pictorial Review.....	1000
American Magazine	1000
5% Saturday Evening Post	
100 words top second reading matter column,	
50 consecutive pages.....	5000
5% Literary Digest	
Similar mechanical sampling.....	5000
TOTAL NUMBER OF WORDS ANALYZED	100,000

*A Study, by French and Koenig.*²¹

(The frequency of occurrence of words of telephone conversations, and the analysis of these words in the simple sounds of speech.)

The material for this study was obtained on typical toll circuits terminating in the City of New York. The process of noting the words of the conversations was carried out in the following manner. During one week the observer recorded nothing but the nouns used, during another week she recorded only the verbs, similarly for the other parts of speech. The observations were continued until data had been obtained on 500 conversations for each part of speech. With this method the results are, of course, not identical with those which would have been obtained had the entire conversations been recorded. It is likely, too, that some words were missed by the observer. Following is an analysis of the parts of speech and the frequencies:

	Number of Words	
	Total	Different
Nouns	11,660	1,029
Adjectives and adverbs	9,880	634
Verbs	12,550	456
Auxiliary Verbs	9,450	37
Pronouns (x).....	17,900	45
Prepositions (x)	12,400	36
Articles (x)	5,550	3
Total	79,390	2,240
(x) Derived from data on less than 500 conversations.		

²¹ FRENCH, NORMAN and KOENIG, WALTER, JR., The Frequency of Occurrence of Speech Sounds in Spoken English, *Acoustical Soc. of Amer.*, 1929, 1.

VII—MATERIAL (WORDS)

The FREQUENCY WORDS used in this presentation of Orthenic Material follows:

A	add	ahead	always	answering
a	added	ahoy	am	answers
able	addition	aid	amend	ant
aboard	address	ail	America	ants
about	administer	ails	American	anvil
above	admire	aim	amethyst	anxious
abroad	admit	air	among	any
absent	ado	airplane	amount	anybody
absolute ³²	advance	airplanes	an	anyhow
accept	advantage	air rifle	anchored	anyone
accident	advise	alarm	ancient	anything
accompany	advise	alas	and	anyway
accomplish	affair	Alice	anew	anywhere
accord	affairs	alike	angel	apart
according ³³	affect	alive	angels	apartment
account	afford	all	angleworms	ape
accustom	afraid	alley	anger	apes
ache	Africa	allies	angry	apparent
achieve	after	alligator	animal	apparently
acorn	afternoon	alligators	animals	appeal
acorns	afterward	allow	Anna	appear
acquaintance	again	ally	Annie	appearance
acre	against	almost	announce	appeared
across	age	alone	announced	apple
act	agent	along	announce-	apples
acted ³³	agents ³³	aloud	ment	applesauce
action	ago	already	annual	appletree
active	agree	also	another	apply
acts	agriculture	although	answer	appoint
actual	ah	altogether	answered	approach

³² In computing frequencies and determining classification each frequency word was analyzed as follows (in the case of the word ABSOLUTE, it appeared thus):

Words	Order Analysis	Sound Analysis
ABSOLUTE	I-II-IV-VII	5, 9, 17, 1
The Roman Numeral Classification refers to Groups One, Two, etc.:		
GROUP ONE (I)—T, D, N		GROUP FIVE (V)—Sh, J, Ch
GROUP TWO (II)—P, B, M		GROUP SIX (VI)—K, G
GROUP THREE (III)—F, V		GROUP SEVEN (VII)—L, R
GROUP FOUR (IV)—S, Z, Th		GROUP EIGHT (VIII)—H

The Arabic Numerals refer to classification of individual sounds:

1—T	5—B	9—S	13—J	17—L
2—D	6—M	10—Z	14—Ch	18—R
3—N	7—F	11—Th	15—K	19—H
4—P	8—V	12—Sh	16—G	

The purpose for this is apparent. It permits of an analysis as to actual sound frequency properly weighted. For instance, the word A-T-T-E-N-D-E-D appears in (Group One) I, because all of the Mutaers are in Group One. This would be an improper weighting against the word A-T which is also Group One. Hence in the second column we have analysis I (T), 3 (N), 2 (D), 2 (D) for the former word with 1 (T) for the latter. This method also makes certain the systematic introduction of words, an integral part of our method.

³³ There appears in our frequency list certain words in plural as well as singular. Likewise various tenses and participial forms appear. These were introduced not arbitrarily, but primarily because of the frequency of their appearance in the material surveyed.

approve	author	barber	bedside	bigger
approximate	authority	bare	bedtime	biggest
approx- mately	auto	barefooted	bee	bike
April	automobile	bark	beef	bill
apron	automobiles	barn	beefsteak	billion
aprons	autos	barns	been	billy
arch	autumn	barnyard	bees	billygoat
are	avail	barrel	beet	billygoats
area	avenue	barrels	beetle	bin
aren't	average	base	beets	bind
arise	avoid	baseball	before	birch
ark	await	basement	beg	bird
arm	awake	bashful	began	birdhouse
armies	away	basin	begat	birdie
armor	awe	basis	beggar	birdies
arms	awful	basket	begin	birds
army	awfully	baskets	beginning	birth
arose	awhile	bat	begone	birthday
around	awoke	bath	begun	biscuit
arrange	ax	bathe	behave	biscuits
arrest	axes	bathing	behaved	bit
arrive		bathroom	behind	bite
arrived	B	bathtub	behold	bites
arrow	baa	battle	being	biting
art	babe	bawl	believe	bitter
article	babies	bay	bell	black
artillery	baby	bays	bellowed	blackberry
as	back	be	bellows	blackbird
ascend	backs	beach	bells	blackboard
ashamed	backward	bead	belong	blacksmith
ashore	backwards	beads	belongs	blade
Asia	bacon	beak	below	blades
aside	bad	beaks	belt	blame
ask	bade	beam	Ben	blank
asked	badge	bean	bench	blanket
asks	badly	bean bag	bend	blankets
asleep	bag	beans	bending	blast
assembly	baggage	bean-stalk	bends	blaze
assist	bag-pipe	bear	beneath	blazing
assure	bags	beard	benefit	bleat
aster	bake	bears	bent	bleated
asters	baked	beast	berries	bleeding
at	bakers	beasts	berry	bless
ate	bakery	beat	beside	blessing
Atlantic	bakes	beaten	besides	blew
attack	baking	beating	Bess	blind
attacks	balance	beats	best	blink
attempt	ball	beautiful	bet	blinked
attend	balloon	beautifully	better	blinks
attended	balloons	beauty	between	block
attention	balls	became	beyond	blocks
attic	banana	because	bib	blood
attitude	bananas	become	bible	bloom
August	band	becomes	bicycle	bloomed
aunt	bang	bed	bicycles	bloomers
auntie	bangs	bedroom	bid	blossom
	bank	beds	big	blossoming

blossoms	bough	brooks	bush	canary
blouse	bought	broom	bushel	candle
blow	bounce	broth	bushes	candlestick
blowing	bound	brother	bushy	candy
blown	bounding	brothers	busily	cane
blows	bouquet	brought	business	cannon
blue	bow	brow	bust	cannot
bluebells	bowl	brown	busted	canoe
bluebird	bowls	Brownie	busy	cans
bluejay	bows	Brownies	but	cans't
blush	bow-wow	brunette	butcher	can't
boar	box	brush	butter	canvas
board	boxes	brushed	buttercup	cap
boards	boxing	brushes	buttercups	cape
boast	boy	bubble	buttered	capes
boasted	boys	bubbled	butterfly	capering
boat	bracelet	bubbles	butterflies	capers
boatman	brain	bubbling	buttermilk	capital
boats	brake	bucket	button	capitol
Bobby	bran	buckles	buttonholes	caps
bob-o'-link	branch	buckwheat	buttons	captain
bobs	branches	bud	butts	capture
bobwhite	brand	buds	buy	captured
body	brass	buffalo	buys	car
boil	brave	buffet	buzz	caravan
boiled	bray	bug	buzzing	carbon
boiling	brayed	buggies	by	card
bold	braying	buggy	bye	cardboard
bolt	bread	bugle		cardinal
bombard	break	bugs	C	cardinals
bombard-	breakfast	build	cab	cards
ment	breaking	building	cabbage	care
bond	breaks	builds	cabin	careful
bonds	breast	built	cabinet	carefully
bone	breath	bulbs	caboose	careless
bonnet	breathe	bull	cafe	cares
boo	breathed	bulldog	cage	Carl
book	breeze	bullets	cake	carnations
bookkeeper	brick	bumblebee	cakes	carpenter
books	bricks	bump	calendar	carpet
boom	bride	bumped	calf	carriage
boot	bridge	bun	California	carried
boots	brief	bunch	call	carries
Bo-peep	bright	bunnies	called	carrot
border	brighteyed	bunny	caller	carrots
bore	brightly	buns	calling	carry
boredom	bring	bunting	calls	carrying
born	bringing	burden	calm	cars
borrow	brings	bureau	calves	cart
bosom	brink	buried	came	carve
boss	British	burn	camel	case
bossy	broad	burned	camels	cases
both	broadcast	burning	camp	cast
both	broke	burnt	campaign	castle
bottle	broken	burst	camping	cat
bottles	brood	bury	can	catbird
bottom	brook	bus	canal	catch

catcher	cheek	clams	coat	congress
catches	cheeks	clang	coats	connect
catching	cheer	clap	cobblers	conquer
caterpillar	cheerful	clapped	cock	conscience
caterpillars	cheese	claps	cocoa	consent
cats	cherries	clasp	coconut	consider
cattle	cherry	class	cocoon	considerable
caught	chest	claw	coffee	considered
cause	chestnut	clay	coin	consist
causes	chestnuts	clean	cold	constant
cave	chew	cleaned	colder	constitute
caw	Chicago	cleaning	collar	construct
caws	chick	clear	collect	construction
cease	chicken	cleared	college	consume
ceased	chickens	clears	colony	contain
cedar	chicks	clerk	color	content
ceiling	chief	click	colored	continent
celebrate	child	clicked	coloring	continue
celery	children	cliff	colors	contract
cell	chill	climate	colt	contrary
cellar	chills	climb	colts	contrast
cement	chimney	climbed	Columbus	contribute
cent	chimneys	climbing	column	control
center	chin	climbs	comb	convenient
central	china	cling	combine	conversation
cents	Chinaman	clinging	come	convince
century	chip	clings	comes	cook
certain	chipmunk	cloak	comfort	cooked
certainly	chocolate	cloaks	comfortable	cookie
chain	chocolates	clock	comic	cookies
chains	choice	clocks	coming	cooking
chained	choke	close	command	cooky
chair	choose	closed	commence	cool
chairs	chooses	closer	commerce	cooling
chalk	chop	closet	commit	coop
chamber	chopped	closing	committee	cooperation
chance	chopping	cloth	common	cop
change	chose	clothes	community	cope
changed	Christian	clothespins	companion	copper
chapel	Christmas	clothing	company	copy
chapter	chuck	cloud	compass	cord
character	chuckled	cloudless	compel	cords
charge	chunk	clouds	complain	core
charity	church	clover	complete	cork
Charles	churn	clown	conceal	corn
charm	circle	club	concern	corporation
chase	circles	cluck	conclude	correct
chases	circum-	clucked	condemn	correspond
chased	stances	clump	condition	correspond-
chasing	circus	clumsy	conditions	ent
chat	citizen	coach	conduct	cosmos
chats	citizens	coachman	conduction	cost
chatter	city	coal	cone	costly
chattering	civil	coarse	cones	costs
cheap	claim	coast	confer	cottage
cheat	clam	coaster	confess	cotton
check	clambered	coasters	confidence	cottongin

couch	creek	curse	decided	dews
cough	creep	curtain	deck	diamond
could	creeping	curtains	declare	diamonds
couldn't	crept	curtsy	declared	Dick
council	crew	custom	decline	dickory
counsel	crib	cut	decorate	did
count	cried	cute	decorated	didn't
counted	cries	cutest	decoration	die
counter	crime	cuts	decorations	died
counting	crimson	cutting	deed	differ
countries	cripple		deeds	difference
country	crisp	D	deep	different
county	critic	dad	deeper	difficult
couple	croak	daddy	deer	difficulty
courage	croaked	daffodils	defeat	dig
course	croaks	daily	defend	digging
court	croak	dainty	defender	digs
cousin	crooked	daisies	defense	dim
cousins	crop	daisy	definite	dime
cover	cross	dam	degree	dimple
covered	crossed	dame	delay	dimpled
covering	cross-eyed	damp	delicate	din
covers	crossing	Dan	delight	dine
cow	crow	dance	deliver	ding
cowboy	crowed	danced	delivered	ding-dong
cowboys	crowd	dancing	delivery	dining
cowcatcher	crowded	dandelion	dells	dining-room
cows	crown	dandelions	demand	dinner
cozy	crowned	dandy	demanded	dip
crab	crowns	danger	Democrat	direct
crack	crumbles	dangerous	den	direction
cracked	crumbs	dare	dentist	dirt
cracker	crumpled	dark	deny	dirty
crackers	crush	darkness	depart	disappear
crackled	crushed	darling	department	discover
cradle	crutch	darn	depend	discovery
cramp	cry	dart	depot	disease
cranberries	crying	dash	depth	dish
crane	cube	dashed	depths	dishes
crank	cubes	date	descend	disloyal
crash	cuckoo	dates	describe	dispatch
crate	cuff	daughter	desert	display
crates	cuffed	dawn	deserve	displayed
crawl	cultivate	day	design	dispose
crawled	cunning	days	desire	dispute
crawling	cup	daytime	desk	distance
crayon	cupboard	dead	despair	distant
crayons	cups	deafness	despise	distinct
crazy	curds	deal	destroy	distress
creak	cure	dear	destruction	distribute
creaked	curious	dearly	detail	district
creaks	curl	death	determine	disturb
cream	curled	debt	develop	ditch
crease	curls	decay	developed	dive
create	curly	deceive	devil	dived
creature	currant	December	devote	divide
credit	current	decide	dew	divine

division	drenched	eagle	empty	exact
dizzy	dress	ear	enclose	examine
do	dressed	early	enclosed	example
dock	dresser	earn	encourage	exceed
doctor	dressmaker	earned	end	excel
does	drew	earnest	ended	excellent
doesn't	dried	earnestly	ends	except
dog	drifting	ears	endure	exchange
dogs	drifts	earth	enemy	excite
doilies	drill	ease	enforce	exclaim
doily	drills	easily	enforced	excuse
doing	drink	east	engage	excused
doll	drinking	Easter	engaged	execute
dollar	drinks	engine	engine	exercise
dollars	dripping	easy	engineer	exist
dolls	drive	eat	engines	expect
dolly	driven	eaten	England	expected
domestic	driver	eaters	English	expense
done	driveway	eating	enjoy	experience
donkey	driving	eats	enormous	expert
donkeys	droop	echo	enough	explain
don't	drooped	echoed	enter	express
door	drooping	economy	entertain	extend
doors	drop	Eden	entire	extreme
doorway	dropping	edge	entrance	eye
dot	drops	Edna	envelope	eyed
double	drove	educate	envy	eyes
doubt	drown	education	equal	F
dough	drowned	Edward	equip	
doughnut	drowns	effect	erase	fabulous
doughnuts	drum	efficiency	eraser	face
dove	drummer	effort	ere	faces
down	drums	egg	erect	fact
downstairs	dry	eggs	error	factory
downtown	duck	Egypt	escape	fade
downey	ducks	eight	Eskimo	fail
dozen	dug	eighteen	especial	faint
draft	duke	eighth	establish	fair
drag	dull	eighty	estate	fairest
dragged	Duluth	either	estimate	fairies
dragging	dumb	elate	eternal	fairy
drain	dump	elbows	Europe	faith
drank	dumps	elect	Eva	faithful
draw	during	election	even	fall
drawer	dust	electric	evening	fallen
drawing	dustpan	electricity	evenings	falling
drawn	dusty	elephant	event	falls
draws	Dutch	elephants	ever	false
dread	duty	eleven	evergreen	falseface
dreadful	dwarf	Ellen	every	fame
dreadfully	dwelt	elm	everybody	familiar
dream	dying	else	everyone	families
dreamed	E	emblem	everything	family
dreamland		Emma	everywhere	famous
dreams	each	emperor	evidence	fan
dreamt	eager	empire	evident	fancy
dreary	eagerly	employ	evil	Fanny

fans	fife	fled	foreign	frill
far	fifteen	fleece	forest	frills
fare	fifty	fleet	forests	fringe
farewell	fifth	flesh	forget	frisked
farm	fight	flew	forgets	frisky
farmer	fighting	flicker	forgive	fritters
farther	figure	flies	forgot	fro
farthest	file	flight	forgotten	frog
fashion	fill	flit	fork	frolic
fast	filled	flits	forks	from
fasten	filling	float	forlorn	front
fastens	fills	floats	form	frost
faster	final	floating	former	frosting
fastest	finally	flock	forms	froth
fat	finding	flog	fort	frowned
fate	find	flood	forth	frowns
father	finds	floor	forts	froze
fathers	fine	flop	fortune	frozen
faucet	finer	floss	forty	fruit
fault	finger	flour	forward	fruits
favor	finger nails	flow	fought	full
favorite	fingers	flower	foul	fully
fear	finish	flowerpot	found	fun
feared	finished	flowers	foundation	fund
fearful	fin	flowing	fountain	funeral
fearless	fir	flown	four	funny
feast	fire	flows	fours	fur
feat	fire engine	fluffy	fourteen	furnace
feather	fireman	flutter	fourth	furnish
feathers	firemen	fly	fowl	furniture
feature	firefly	flying	fowls	furry
February	fireplace	fodder	fox	further
fed	fires	foe	foxes	future
feed	fireside	fold	fragrant	fuzzy
feeding	firm	folded	frail	
feeds	first	folding	frame	G
feel	fish	folds	franc	gaily
feelers	fished	folk	France	gain
feeling	fisher	folks	Frank	gained
feelings	fisherman	follow	Fred	gales
feet	fishes	followed	free	gallop
fell	fishing	following	freedom	galloping
fellow	fit	follows	freeze	game
felt	fits	folly	freight	games
female	five	fond	French	garage
fence	fix	fonder	frequent	garbage
fern	fixed	food	fresh	garden
ferry	fixing	fool	freshness	garment
ferry-boat	flag	foolish	fret	gas
fetch	flags	foot	Friday	gasoline
fetches	flakes	football	friend	gate
fever	flame	foot-stool	friendly	gates
few	flap	for	friends	gather
fiddle	flash	forbid	friendship	gathered
field	flat	force	fright	gathers
fields	flats	forces	frighten	gathering
fierce	flatter	forehead	frightened	gave

gaudy	God	griddle	hanging	he'd
gaze	goes	grief	hangs	heel
gay	going	grieve	happen	heels
gee	gold	grind	happened	height
geese	golden	grinds	happiness	held
gem	golden-rod	groan	happily	he'll
general	Goldilocks	groceries	happy	hello
generally	golf	grocery	harbor	help
generate	gone	ground	hard	helped
generous	gong	group	harder	helper
gentle	good	grove	hardly	helpers
gentleman	good-by	grow	hare	helping
gently	good morning	growing	hark	helps
George	goodness	growl	harm	hem
geranium	good-night	growled	harness	hen
German	goods	grown	Harold	hence
Germany	goody	grows	Harry	henceforth
germs	goose	growth	harvest	Henry
get	gorgeous	grudged	has	hens
gets	got	gruff	hash	her
getting	govern	grunt	hasn't	herd
giant	government	guard	haste	here
giants	governor	guess	hasten	here's
giddy	gown	guest	hat	hero
gift	grab	guide	hatch	heroes
gifts	grace	guilty	hatched	hers
giggled	gracious	guinea-pig	hatchet	herself
gilded	grade	gulf	hate	he's
gill	gradual	gum	hats	hey
gills	graham	gun	haul	hickory
gin	grain	guns	hauling	hid
gingerbread	grains	guy	have	hide
giraffe	grand		haven't	hiding
girl	grandfather	H	having	high
girls	grandma	ha	hawk	higher
give	grandmother	habit	hay	highest
given	grandpa	had	hay-field	highway
gives	grant	hadn't	haystack	hill
giving	grape	hail	he	hills
glad	grape-fruit	hair	head	hillside
glance	grapes	hairs	headed	hillsides
glass	grass	half	heads	him
glasses	grasses	hall	heal	himself
glee	grasshopper	Hallowe'en	health	hind
listening	grassy	halls	healthy	hire
glitter	grate	ham	heals	his
globe	grateful	hammer	heap	history
glorious	grave	hammers	heaps	hit
glory	gravy	hams	hear	hitch
glove	gray	hand	heard	hitched
gloves	great	handed	hearing	hither
glow	greater	handful	hears	hits
glue	greatest	handkerchief	heart	hive
gnats	greatly	handle	hearts	hives
gnawed	green	hands	heat	ho
go	greet	handsome	heaven	hoe
goat	grew	hang	heavy	hold

holding	humming	India	jacket	keeping
holds	humming-	Indian	jacks	keeps
hole	bird	Indians	jail	kept
holes	humpty-	indicate	James	kennel
holiday	dumpty	indigo	Jane	kernel
hollow	humor	individual	janitors	kettle
home	hundred	indoors	January	key
homeless	hung	industrial	jar	kick
homelike	hunger	industry	jarred	kicked
homely	hungry	influence	jars	kid
homemade	hunt	inform	jaw	kill
homes	hunter	information	jay	killed
honest	hunting	injure	Jean	killing
honey	hunts	ink	jello	kills
honey-bee	hurrah	innocent	jelly	kilt
honey-bees	hurry	inquire	Jennie	kind
honk	hurt	insect	Jessie	kindergarten
honor	hurts	insects	Jesus	kindly
honorable	husband	inside	jewel	kindness
hood	hush	insist	jewels	kinds
hoof	hut	inspire	jewelry	king
hook		instance	Jewish	kingdom
hooks	I	instant	jig	kings
hoop	ice	instead	Jill	kiss
hoops	ice cream	institute	Jimmie	kissed
hop	icicles	instruct	job	kisses
hope	I'd	instruction	Joe	kitchen
hopping	idea	instrument	jog	kite
hops	ideal	insure	John	kitten
horn	ideas	intend	join	kittens
horns	idle	interest	joint	kitty
horrid	if	interesting	joke	knee
horse	ill	into	jokes	knees
horses	I'll	introduce	jolly	knelt
horseshoe	I'm	invest	Joseph	knew
horseshoes	image	invitation	Josephine	knife
hose	imagine	invite	journey	knight
hospital	immediate	involve	joy	knights
host	immediately	involved	joyful	knit
hot	immense	Iowa	judge	knitting
hotel	immortal	Irish	judgment	knits
hotter	import	iron	juice	knives
hour	importance	ironing	juicy	knob
hours	important	is	July	knock
house	impossible	island	jump	knocked
household	improve	isle	jumped	knocking
housekeeper	improved	isn't	jumping	knot
houses	in	issue	jumps	know
how	inch	it	June	knowledge
however	incident	Italian	junk	known
howl	incline	Italy	just	knows
howled	include	its	justice	
how's	income	itself		
huge	increase	I've		
hum	increased		K	
human	indeed	J	kangaroo	labor
humble	independent	Jack	Kate	lace
			keep	lack

L

lad	leaped	limp	loss	manual
ladder	leaps	limping	losses	manufacture
ladders	learn	line	lost	many
ladies	learned	linen	lot	map
lady	learning	lines	lots	maple
laid	learns	lingered	loud	maples
lain	lease	lion	louder	marble
lake	leased	lions	love	marbles
lamb	least	lip	loved	march
lambs	leather	lips	lovely	marched
lame	leave	lisps	lover	marching
lamp	leaves	list	loves	mark
lamps	leaving	listen	loving	marked
land	led	listened	low	market
landlord	left	listening	lower	marks
lands	leg	listing	loyal	marriage
lane	legs	lit	luck	married
language	lemon	litter	lullabies	marrow
lantern	lend	litters	lullaby	marry
lanterns	length	little	lumber	Martin
lap	less	live	lunch	Mary
lapped	lesson	lived	lungs	mask
large	lessons	liveliest	luxury	mass
largely	lest	lively	lying	mast
larger	let	lives		master
largest	let's	living	M	mat
lark	letter	load	ma	match
last	letters	loaded	Mabel	matches
latch	lettuce	loaf	machine	mate
late	level	loan	machinery	material
later	lever	loaves	machines	mates
Latin	liberty	lobster	mad	mats
latter	library	local	made	matter
laugh	lick	locate	magazine	mattress
laughed	licked	lock	magic	may
laughing	licking	locked	magnificent	maybe
laughter	lid	locker	mag-pie	Mayflower
launch	lie	locket	maid	mayor
laundry	life	locks	maiden	me
lavender	lift	lodge	mail	meadow
law	lifted	log	mailman	meadows
lawn	lifts	logs	main	meal
laws	light	London	maintain	meals
lay	lightened	lone	majority	mean
lazy	lighthouse	long	make	meaning
lead	lightning	longed	maker	means
leader	lights	longer	makes	meant
leading	like	lonely	making	measles
leaf	liked	look	mama	measure
leafless	likely	looked	man	meat
leafy	likes	looking	manage	mechanic
league	lilac	looks	managed	medal
leak	lilies	loose	manager	medicine
leaked	lily	loosened	manger	meet
leaking	limb	lop	mankind	meeting
lean	limbs	Lord	manner	meets
leap	limit	lose	manners	melt

melted	mischievous	mourn	near	nips
melting	miss	mourned	nearer	no
member	missed	mouse	nearest	noble
members	misses	mouth	nearly	nobody
memory	mist	mouths	neat	nod
men	mistake	move	neatest	nodded
mend	mistaken	moved	neatly	nodding
mending	mister	movement	necessary	nods
mends	mistress	movie	necessity	noise
mental	Missus	movies	neck	noisy
mention	(Mrs.)	mowing	necks	non
meow	mite	mows	necktie	none
merchant	mitten	much	Ned	nook
mercy	mittens	mud	need	noon
mere	mix	muddy	needed	nor
merely	mixed	muff	needle	normal
merit	moans	muffin	needlecase	north
merrily	mock	mule	needles	northern
merry	mocks	multiply	needs	nose
mess	mocking	munching	neglect	noses
message	model	murder	negress	not
messenger	moderate	murmur	negro	note
met	modern	music	negroes	nothing
metal	modest	musical	neighbor	notice
method	mold	musk	neighbor-	notion
mew	Molly	must	hood	November
mewing	moment	mustache	neither	now
mice	Monday	musn't	Nelly	nowhere
middle	money	muscles	Nero	numb
midnight	monkey	mutton	nest	number
midst	monkeys	my	nestle	numbers
might	monster	myself	nests	numbness
mighty	month	mystery	net	numerous
mild	months		neutral	nurse
mile	monument	N	never	nursery
miles	moon	nail	new	nut
military	moonlight	nailed	new-mown	nutting
milk	mop	nails	news	nuts
milked	moral	naked	newspaper	
milks	more	name	New York	O
mill	morn	named	next	oak
millar	morning	names	nibble	oaks
million	mornings	namesake	nibbles	oars
millions	mortal	nap	nibbling	oat
Milton	mosquito	napkin	nice	oatmeal
mind	mosquitoes	napkins	nicer	oats
mine	moss	naps	nicest	obey
miner	mosses	narrow	Nick	object
miners	most	nasturtium	nickel	oblige
minister	mother	nation	night	observe
Minnie	mothers	national	night-cap	obtain
minor	motion	nations	nightgown	occasion
minute	motor	native	nights	occupy
minutes	mound	natural	nine	occur
mirror	mount	nature	nineteen	ocean
mirrors	mountain	naughty	ninety	o'clock
mischief	mountains	navy	ninth	October

odd	ostrich	pancakes	peanuts	picnic
oddly	other	pans	pear	picture
o'er	others	pansies	pearl	pictures
of	otherwise	pansy	pears	pie
off	Otto	pant	peas	piece
offend	ouch	pants	peck	pieces
offense	ought	papa	pecked	pies
offensive	ounce	paper	peculiar	pig
offer	our	papers	peel	pigeon
office	ours	papoose	peep	pigeons
officer	ourselves	parade	peeped	piggy
officers	out	paradise	peeping	pigs
offices	outdoors	parasol	peeps	pile
official	outer	parcel	peevish	piled
officials	outside	pardon	peg	pilgrims
oft	oven	parent	pegs	pillow
often	over	park	pelt	pillows
oh	overalls	parlor	pen	pills
oil	overboard	parrot	pencil	pimple
old	overflowed	parrots	pencils	pin
older	overheard	part	pennies	pinched
olive	owl	particular	penny	pine
omit	owls	partly	pens	pineapple
omelet	own	partner	people	pink
on	owned	parts	peoples	pinks
once	owner	party	per	pins
one	owners	pass	perceive	pipe
ones	owning	passage	perfect	pipes
onion	owns	passed	perform	pippins
onions	ox	passenger	perfume	pit
only	oxen	passes	perhaps	pit-a-pat
open	oxygen	passing	period	pitch
opened	P	passion	perish	pitcher
opens	pa	past	permit	pity
operate	pace	paste	permitted	place
operation	pack	pasteboard	person	placed
opinion	package	pasted	personal	places
opportunity	pad	pasture	persons	plain
oppose	paddle	pat	pet	plainly
opposite	page	patch	petals	plan
or	pages	path	Peter	plane
orange	paid	patience	Peter Pan	planes
oranges	pail	patient	Peter Rabbit	plank
orchard	pain	patriot	petted	planning
orchards	pains	patted	petticoat	plans
orchestra	paint	pattern	Philip	plant
order	painter	Paul	physical	planted
orders	painter	pauper	physician	planting
ordinary	painting	paw	piano	plants
ore	paints	paws	pianos	plate
organ	pair	pay	pick	plates
organization	pairs	pea	pick-ax	platter
organize	palace	peace	pick-axes	play
original	pale	peaceful	picked	played
oriole	palm	peach	picking	player
ornament	pan	peaches	pickles	playful
orphans	pancake	peanut	picks	playground

playhouse	pork	prick	pulled	rack
playing	porridge	pricked	pulling	radiator
playmate	port	pride	pulls	radio
playmates	portion	priest	pump	radish
plays	position	primer	pumpkin	radishes
plaything	possess	prince	pumpkins	rag
playthings	possession	princess	punch	rage
pleasant	possible	principal	punched	rags
pleasantest	possibility	principle	punish	raid
please	post	print	punishment	rail
pleased	postman	printed	pup	railing
pleases	postmaster	prison	pupil	railroad
pleasure	post-office	prisoner	puppies	railroads
plenty	pot	private	puppy	rails
plot	potato	prize	purchase	railway
plow	potatoes	probable	pure	rain
plowing	pots	probably	purple	rainbow
pluck	potter	problem	purpose	raindrop
plucked	pound	proceed	purposes	raindrops
plum	pounds	process	purr	rained
plums	pour	proclaim	purse	raining
plunge	pours	produce	pursue	rains
pocket	pout	product	push	rainy
pocketbook	powder	products	pushed	raise
pockets	power	professor	pushes	raises
pod	powerful	profit	pushing	raisin
Pods	practical	program	pussy	raisins
poem	practice	progress	put	rake
poet	praise	promise	puts	rakes
point	praised	prompt	putting	ran
pointed	prank	pronounce		ranch
poison	pranks	proof	Q	rang
poisoned	pray	propeller	quack	range
poke	prayer	proper	quality	rank
poker	prayers	property	quantity	ranks
pokers	preach	prophet	quarrel	rap
pole	precious	proportion	quarter	rapid
police	prefer	propose	queen	raps
policeman	prepare	proposed	queer	rare
polish	presence	prospect	question	rat
polite	present	protect	questions	rate
politic	presents	proud	quick	rather
political	preserve	prove	quickly	rats
pollen	president	provide	quiet	raw
pond	press	provided	quietly	reach
pondered	presses	province	quill	reached
ponies	pressure	provision	quilt	read
pony	pretend	provoked	quit	reading
pool	prettier	prowling	quite	reads
poor	prettiest	pruned		ready
pop	pretty	public	R	real
pop-corn	prevail	publish	rabbit	realize
poppies	prevent	pudding	rabbits	really
poppy	previous	puddle	race	realm
pops	prey	puddles	racers	reap
population	price	puff	races	reaped
porch	prices	pull	racing	rear

reared	required	robe	rude	sap
reason	reserve	Robert	rudely	sash
reasons	resolve	robin	rug	sat
receive	resource	robins	rugs	satins
received	respect	rock	ruin	satisfactory
recent	respectfully	rock-a-by	rule	satisfy
recently	responsible	rocked	ruler	Saturday
recess	rest	rocker	run	sauce
reckon	resting	rocking	rung	saucer
recognize	rested	rocking-	running	saucers
record	restore	horses	runs	save
recover	rests	rocks	rush	saved
red	result	rod	rushes	saving
redbreast	retailer	rode	rushing	saw
redde	retire	rogue	Russian	saws
reduce	return	roll	rusty	say
refer	reveal	rolled		saying
refresh	revenge	roller	S	sayings
refuse	review	rolling	sack	says
regard	reward	rolls	sacred	scabs
region	rhyme	Roman	sacrifice	scale
register	rib	Rome	sad	scales
regular	ribbon	romp	saddle	scamper
reign	ribbons	romper	Sadie	scampered
reindeer	rice	romping	safe	scampering
reins	rich	romps	safest	scant
rejoice	rid	roof	safety	scarce
relate	riddle	room	said	scare
relation	riddles	rooms	sail	scared
relative	ride	rooster	sailboat	scarf
relief	rides	root	sailboats	scarlet
relieve	ridge	rooting	sailed	scat
religion	riding	roots	sailing	scatter
religious	right	rope	sailor	scattered
relish	rills	ropes	sailors	scatters
remain	rim	rose	sails	scene
remained	ring	roses	saint	scent
remarked	ringing	rosy	sake	scepter
remember	rings	rotten	salad	school
remedy	rinsed	rough	salary	schoolhouse
remove	ripe	roughly	sale	science
removed	ripen	round	Sally	scissors
rend	ripening	rounded	salt	scold
render	rise	route	salute	scolded
rent	river	rove	Sam	scolds
repair	rivers	rover	same	scooter
repeat	roach	row	sand	score
replied	road	rowboat	sandals	scorn
reply	roadside	rowed	sandpaper	scotch
report	roar	rowing	sand pile	Scotchman
reported	roared	rows	sandwich	Scotland
reports	roaring	royal	sandwiches	scour
represent	roars	rub	San Fran-	scoured
representa-	roast	rubbed	cisco	scout
tive	roasted	rubber	sang	scouts
request	rob	rubbers	sank	scrape
require	robber	rubies	Santa Claus	scraps

scratch	service	shining	sighed	slap
scratches	set	shiny	sighs	slaps
scream	sets	ship	sight	slate
screeches	setter	shipment	sign	slates
screens	setting	shipping	signal	slats
scribble	settle	ships	signs	slave
sea	settlement	shirt	silence	slay
seabird	seven	shivering	silent	sled
seahorse	seventeen	shock	silk	sleds
seal	seventh	shod	silky	sleep
seals	seventy	shoe	sill	sleeping
search	several	shoemaker	silly	sleeps
searching	severe	shoes	silver	sleepy
seashells	sew	shone	similar	sleeve
seashore	sewing	shook	simmering	sleigh
season	sews	shoot	simple	slept
seat	shades	shooting	simply	slice
seated	shadow	shoots	sin	slid
seats	shake	shop	since	slide
second	shakes	shore	sincere	sliding
secret	shaking	shorn	sing	slight
section	shall	short	singer	slip
secure	shallow	shorter	singing	slipped
see	sham	shot	single	slipper
seed	shame	should	sings	slippers
seedling	shames	shoulder	sink	slippery
seeds	shan't	shoulders	sinking	slope
seeing	shape	shouldn't	sip	slow
seek	shaped	shout	sir	slowly
seem	shapes	shouted	sister	slumber
seemed	share	shouts	sisters	sly
seems	shark	shovel	sit	small
seen	sharp	shoveling	sits	smaller
sees	shaven	show	sitting	smart
see-saw	she	show-case	situation	smell
seize	shear	showed	six	smelling
seldom	shears	shower	sixteen	smells
select	she'd	showers	sixth	smile
self	shed	showery	sixty	smiled
selfish	sheds	showing	size	smiles
sell	sheep	showman	skate	smiling
seller	sheet	shown	skates	smith
selling	sheets	shows	skating	smoke
Senate	shelf	shrill	skid	smokestack
send	shell	shuffled	skies	smooth
sending	she'll	shut	skiis	snail
sends	shells	shuts	skill	snake
sense	shelter	sick	skim	snakes
sent	shelves	sicken	skimmed	snap
sentence	shepherd	sickness	skimmer	sneeze
sentiment	shepherds	side	skin	snow
separate	she's	sides	skinny	snowball
September	shield	sidewalk	skip	snowballs
serious	shin	sidewalks	skipping	snowflake
servant	shine	sift	skirt	snowing
serve	shines	sifter	sky	snowman
served	shined	sigh	slanting	snowmen

snows	spank	sprinkle	steep	straws
so	spanking	spruce	steeple	stray
soak	spare	sprung	steering	stream
soaked	spark	spy	stem	streams
soap	sparkle	square	stems	street
sob	sparks	squares	step	street car
sober	sparrow	squash	stepped	street cars
social	sparrows	squaw	steps	streets
society	speak	squeak	stern	strength
sock	speaking	squeeze	stick	stretch
socks	speaks	squeezed	sticking	stretched
sod	spear	squirrel	sticks	strike
soda	spears	squirrels	sticky	strikes
soft	special	squirt	stiff	striking
softly	sped	stable	stile	string
soil	speech	staff	still	strings
sold	speed	stage	sting	strip
soldier	spell	staid	stingy	stripe
soldiers	spend	stain	stir	stripes
sole	spends	stair	stitch	strips
solid	spent	stairs	stitches	stroke
some	spice	stale	stitching	stroll
somebody	spider	stalks	stock	strong
someone	spiders	stall	stocking	stronger
somersault	spied	stalls	stockings	struck
something	spike	stamp	stole	struggle
sometime	spill	stamped	stolen	stuck
sometimes	spilled	stamps	stomach	student
somewhat	spills	stand	stone	study
somewhere	spin	standard	stones	stuff
son	spinach	standing	stood	stuffed
song	spines	stands	stool	stump
songs	spinning	star	stoop	stun
soon	spins	starfish	stooped	stung
sore	spirit	stars	stop	style
sorrow	spirits	start	stopped	subject
sorrowful	spit	started	stopping	submarine
sorry	spite	starter	stops	submit
sort	splash	starts	store	substitute
sought	splashed	state	stored	succeed
soul	splendid	statement	storekeeper	success
sound	splinter	states	stores	successful
soundly	spoil	station	stories	such
sounds	spoiled	statute	storing	sucker
soup	spoke	stay	storm	sudden
sour	sponge	stayed	stormy	suddenly
source	spoon	staying	story	suffer
south	spoons	stays	stout	suffered
southern	sport	steady	stove	sufficient
sow	spot	steak	straight	sugar
sowed	spots	steal	straighten	suggest
sowing	spout	steam	strain	suit
space	sprang	steamboat	strange	suits
spade	spread	steamers	stranger	sulkily
Spain	spring	steamships	strangest	sum
Spanish	springs	steed	straw	summer
	springtime	steel	strawberries	summon

sun	tables	tells	thirst	timid
sun-beam	tacks	temper	thirsty	tin
Sunday	tadpole	temple	thirteen	tinkling
Sunday	tag	tempt	thirteenth	tins
school	tail	ten	thirty	tiny
sung	tailor	tend	thirty-one	tip
sunlight	tailors	tended	this	tipped
sunning	tails	tender	thistle	tip-toed
sunny	take	tends	Thomas	tire
sunshine	taken	tennis	thorn	tired
superior	takes	tent	thorough	tires
supper	taking	tenth	those	'tis
supplies	tale	tents	thou	tissue
supply	tales	term	though	title
support	talk	terms	thought	to
suppose	talked	terrible	thousand	toad
supposed	talking	territory	thousands	toast
sure	talks	terror	thread	tobacco
surprise	tall	test	threaten	today
surround	taller	than	three	toe
swallow	tallow	thank	threw	toes
swam	tambourine	thanks	throat	together
swarm	tame	thanksgiving	throne	toil
sway	tan	that	through	toiled
swaying	tangle	that'll	throughout	toilers
sweater	tank	that's	throw	toilet
sweating	tap	thaw	throwing	toiling
sweep	tapping	thaws	thrushes	told
sweeping	tardy	the	thrust	Tom
sweeps	task	theater	thumb	tomatoes
sweet	tassel	thee	thumbs	Tommy
sweeter	taste	their	thumped	tomorrow
sweetly	tasted	them	thunder	ton
sweet peas	tastes	themselves	thundered	tone
sweets	tattoo	then	Thursday	tones
swell	tattered	thence	thus	tongue
swept	taught	there	thy	tonight
swift	tax	therefore	thyme	tons
swiftly	taxi	there's	tick	too
swim	tea	these	ticked	took
swimming	teach	they	ticket	tool
swimming	teacher	they'd	tickets	tooth
pool	teachers	they'll	ticks	toothbrush
swims	teaching	they're	tick-tock	toothpaste
swing	team	thick	tide	toothpick
swinging	teams	thicket	tie	top
swings	teapot	thief	tied	tops
switch	tear	thimble	ties	tore
sword	tears	thin	tiger	torn
swords	tease	thine	tigers	toss
syrup	teddy	thing	tight	tossed
system	teddy bear	things	tightly	total
	teeny	think	till	touch
	teeth	thinking	tilt	touched
T	telephone	thinks	Tim	toward
tabby	tell	thinner	time	towel
table	telling	third	times	tower
tablecloth				

town	truck	umbrella	various	walk
toy	trucks	umbrellas	varnish	walked
toys	true	uncle	vary	walking
trace	truly	uncles	vase	walks
track	trumpet	under	vast	wall
tracks	trunk	underneath	vegetable	walls
tractor	trunks	understand	vegetables	walnut
trade	trust	understood	vein	walnuts
trail	truth	underwear	veins	wander
trails	try	unfairly	velvet	wanders
train	trying	unhappy	verse	want
training	tub	uniform	very	wanted
trains	Tuesday	union	vessel	wants
tramp	tuffet	unite	vessels	war
transport	tug	universal	vest	warm
transporta-	tulip	universe	vex	warmed
tion	tulips	university	vice	warmer
trap	tumble	unkindness	victor	warms
travel	tumbled	unknown	victory	warmth
traveler	tumblers	unless	view	warn
tray	tumbling	untie	viewed	warp
tread	tune	until	village	warrior
treasure	tunnel	unto	vine	was
treat	tunnels	up	vines	wash
treats	turkey	upon	violet	washed
tree	turkeys	upper	violets	washes
tree-top	turn	upright	violin	washing
tree-tops	turned	upset	Virginia	wasn't
trees	turning	upsetting	virtue	waste
tremble	turnip	upstairs	visit	wastes
trench	turnips	uptown	visited	watch
trial	turns	upward	visits	watched
triangle	turpentine	urchin	voice	watches
tribe	turtle	urchins	volume	watching
trick	twelve	urge	vote	water
tricked	twenty	us	vow	water-cress
tricks	twenty-eight	use	voyage	watered
tricycle	twenty-five	used		watermelon
tried	twenty-four	useful	W	water-pail
tries	twenty-nine	uses	wade	waters
trill	twenty-one	using	waded	wave
trills	twenty-seven	usual	wag	waved
trim	twenty-six	utensils	wage	waves
trimmed	twenty-three	utter	wages	waving
trimming	twenty-two		wagging	wax
trims	twice	V	waggon	way
trip	twig	vacation	waggons	ways
tripping	twin	vain	waist	we
troop	twine	valentine	wait	weak
troops	twinkle	valentines	waited	weakness
tropical	twins	valley	waiter	wealth
trot	twists	valuable	waiting	weapon
trots	two	value	waits	wear
trotted	type	van	wake	wears
trouble		vanish	waked	weary
trough	U	vapor	wakened	weather
trousers	ugly	variety	wakes	weave

web	where	willingly	won	wrestled
webs	wherever	willow	wonder	write
we'd	where'd	wills	wonderful	writing
wedding	where's	win	won't	written
Wednesday	whether	wind	wood	wrong
wee	which	windmill	wooden	wrote
weed	whichever	windmills	woodland	wrought
weeds	while	window	woodman	
week	whined	window-pane	woodmen	X
weeks	whip	windows	woodmice	xylophone
weep	whipped	windy	woodpecker	
weigh	whiskers	wine	woods	Y
weight	whisper	wing	wool	yard
welcome	whispered	wings	word	yarn
welcomed	whistle	winter	words	ye
well	whistled	winters	wore	year
we'll	white	wipe	work	years
wells	whiteness	wiped	worked	yellow
wend	whittled	wire	worker	yes
went	who	wires	working	yes'm
wept	whoa	wisdom	works	yesmam
were	whoever	wise	world	yesterday
we're	whole	wisest	worm	yet
weren't	whom	wish	worms	yield
west	who's	wished	worn	yonder
western	whose	wishes	worried	you
wet	why	wit	worry	you'd
wets	wick	witch	worse	you'll
wetter	wicked	witches	worship	young
wetting	wide	with	worst	your
we've	width	withdraw	worth	you're
what	wife	withdrew	worthy	yours
whatever	wig	wither	would	yourself
what's	wigwam	withered	wouldn't	youth
wheat	wild	within	wound	you've
wheel	wilderness	without	wrap	
wheelbarrow	wildly	witness	wraps	Z
wheeling	wildwood	woe	wreath	zeal
wheels	will	woke	wreck	zealous
when	William	wolf	wrecks	zebra
whence	Willie	woman	wren	zone
whenever	willing	women	wrens	zoo

VIII—ANALYSIS OF SOUNDS

An analysis of the frequency of sounds is exceedingly informative and interesting.

It was suggested earlier that originally the "Curve of Articulation" was the product of our clinical observations. The final analysis of 'frequencies,' however, clearly substantiates that which seemed even without statistical substantiation a theoretically logical and subsequently successful method.

The analysis showing arithmetic per cent. frequency follows:

Sound	Frequency	Per Cent.	Group	Frequency	Per Cent.
1 (T)	1710	10.260	} I	4,834	29.01
2 (D)	1222	7.332			
3 (N)	1902	11.413			
4 (P)	913	5.478	} II	2,246	13.48
5 (B)	610	3.660			
6 (M)	723	4.338			
7 (F)	509	3.054	} III	789	4.73
8 (V)	280	1.680			
9 (S)	1624	9.744	} IV	2,597	15.58
10 (Z)	783	4.698			
11 (TH)	190	1.140			
12 (SH)	239	1.434	} V	589	3.53
13 (J)	177	1.062			
14 (CH)	173	1.038			
15 (K)	1175	7.050	} VI	1,772	10.63
16 (G)	597	3.582			
17 (L)	1414	8.483	} VII	3,563	21.38
18 (R)	2149	12.895			
19 (H)	276	1.66	VIII	276	1.66
Total ³⁴	16,666	100.00		16,666	100.00

It would be an erroneous impression if the idea were conveyed that the "Curve of Articulation" depended for its validity on the preponderance of Sound One (T) with a gradual decrease to Sound Nineteen (H).³⁵ The crucial facts are rather as indicated by the composite chart showing Distribution of Mutaers.

³⁴ According to Dewey's analysis:

P, B, T, D constitute 25 per cent. of all our sounds.

P, B, T, D, K, G, F, V, Th constitute 50 per cent. of all our sounds.

P, B, T, D, K, G, F, V, Th, S, Z, Sh, Ch, J, M, N, NG constitute 75 per cent. of all our sounds.

Dewey's analysis of his entire group of words on the 48 sound basis of the revised scientific 'Alphabet arranged in Phonetic Order' follows:

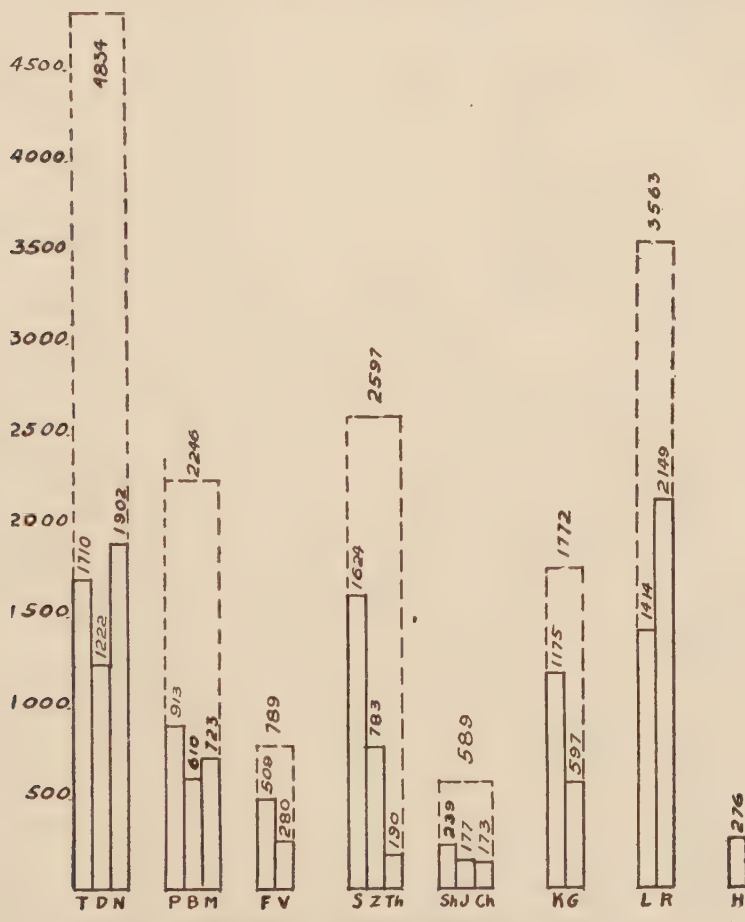
Sound	Per Cent	Sound	Per Cent	Sound	Per Cent
p	2.04	s	4.55	r	6.88
b	1.81	z	2.97	w	2.08
t	7.13	sh (var.)	0.82	y	0.60
d	4.31	3	0.05	h	1.81
k	2.71	ch (var.)	0.52		
g	0.74	j	0.44	Consonants	62.10
f	1.84	m	2.78	Vowels	37.90
v	2.28	n	7.24		
th (var.)	0.37	o	0.96	Total	100.00
oh (var.)	3.43	l	3.74		

³⁵ The use of plurals, 'S' or 'Z' sound, the past tense 'D' or 'T,' the participial ending 'ING,' the present tense 'S' or 'Z' cannot be computed exactly because the classification would depend so much on use and meaning of words rather than spelling alone. But the totals are not significantly altered by them. A total of the sounds is as follows:

Past Tense	Plurals	Participials	Present Tense
ED 298	Z 454	ING 228	S 71
T 14	S 140		Z 113

The admission of these sounds into our frequency results quite obviously are not factors of significance.

The dotted lines indicate total of sounds within the group. The first three groups, I, II, III, involving first, tongue and upper teeth, then lips, then upper teeth and lower lip, respectively, show a decreasing series. The next Groups, IV, and V, beginning



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with the teeth and continuing in proximation of the jaws show a similar decrease. An analogous situation obtains with Group VI. The reversal of frequency with group VII (L, R), though statistically it would seem to affect the consistency of our curve by

not appearing in relation to other sounds, is justified by the difficulty encountered in the correction of the articulatory defect.

This analysis will perhaps also clear up the disputed aspects of the relative difficulty of speech sounds. The reason some sounds appear so often in the rôle of 'trouble makers' is because of their actual frequency.

While it is not essentially within the scope of this presentation, the interesting observation has been made that the Sound M (6) constitutes only 4.338 per cent. (723) of the 16,666 sounds of our frequency words in comparison with T (1) as 10.260 per cent. (1710), or N (3), 11.413 per cent. (1902). Certainly further investigation suggests itself in view of our too facile theory of the origin of speech and the explanation of the 'M' sound and its occurrence in the word 'Mama' in nearly every language. There is some psychological explanation due us to account for the phenomenon which makes so minor the contribution of an elemental and relatively easy sound.

There are other justifications and causes for the selection of a word frequency list.

The value of 'frequency' words is twofold; first, if an individual with a speech defect could be given the assurance of perfect reproduction of these 5138 words, 95 per cent. of his speech difficulty would be relieved. This is a simple mathematical computation. However, there is the second and more subtle psychological factor involved. Regardless of which theory of emotions one accepts, one cannot deny the presence of an instability in the stammerer at the moment of a speech seizure. It follows that if the individual could feel assured of his competency to successfully articulate words forming such a large percentage of his speech, there would result a 'hangover' to advantage weight his personal equation enabling him to proceed bravely to the new word with facility and ease.

According to Dewey,³⁶ with whom our analysis agrees, six (6) words:

the, of, and, to, a, in

comprise 20% of ordinary English; nine (9) words:

the, of, and, to, a, in, that, it, is³⁷

comprise 25% of ordinary English; sixty-nine (69) words:

the, of, and, to, a, in, that, it, is, I, for, be, was, as, you, with, he, on, have, by, not, at, this, are, we, his, but, they, all, or, which, will, from, had, has, one, our, an, been,

³⁶ DEWEY, GODFREY, *Op. Cit.*

³⁷ According to Smith, Madorah Elizabeth, *Op. Cit.*, the ten words of greatest frequency are: I, IS, IT, YOU, THAT, DO, A, THIS, NOT, THE. This investigation also furnishes the information that the average number of words in the vocabularies of 273 children at the age of six years is 2,562.

no, their, there, were, so, my, if, me, what, would, who, when, him, them, her, war, your, any, more, now, its, time, up, do, out, can, than, only, she, made

comprise 50% of ordinary English; one hundred seventeen (117) words comprise 56% of ordinary English; five hundred (500) words comprise 66 2/3% of ordinary English; seven hundred thirty-two (732) words comprise 75% of ordinary English; one thousand twenty-seven (1027) words comprise 78.6% of ordinary English.

Not varying greatly but because of the nature of the investigation, the twenty-five commonest words of English as recorded by French and Koenig³⁸ from telephone conversations are as follows:

TELEPHONE CONVERSATION

Words	No. of Conversations	Total Occurrence
I	467	3990
You	499	3540
The	496	3110
A	487	2060
On	458	2046
To	472	1942
That	397	1792
It	417	1605
Is	419	1506
And	391	1363
Get	393	1360
Will	402	1305
Of	396	1190
In	408	1170
He	297	1115
We	294	1100
They	253	913
See	328	887
Have	367	883
For	330	823
Know	338	753
Don't	301	640
Do	302	638
Are	293	618
Want	297	599
Total		36,948

IX—DISCUSSION AND CONCLUSION

The classification made on the basis of the sound analysis herein presented made possible a progressive allocation of frequency words and this new method is now in actual use in the

³⁸ FRENCH and KOENIG, *Op. Cit.*

University of Pennsylvania Speech Clinic. Each word is presented only after its component sounds have been the subject of training and practice. The value of the employment of this method lies in the complete mastery of each step before proceeding to the succeeding one. Group one is propedeutic to group two; group two to group three, and so on. Complete mastery means: First, correct breathing; second, we must be certain that the case can, at first consciously, and later subliminally, effect the proper Oratans.

If one can take a plaster cast of the head and with the use of bellows and a vibrating reed, effect speech, it does not seem an error of analogy to maintain that the individual with a speech defect *must* speak properly when he has mastered the last step of the corrective measures: the third, the combination of correct breathing and the utilization of breath with the correctly functioning Oratans. The slightest deviation from the absolutely correct Oratans is a sufficiently disturbing factor to throw off balance the entire speech mechanism.

How fine and small a change in stimulation may affect an organism is emphatically demonstrated to us in the phenomenon of distance perception. On the basis of physiology and psychology it is known that our cognition of distance is largely determined by the delicate muscular contractions and relaxations of the ciliary processes and the radial and circular fibres of the iris. Until we encounter these facts in formal laboratory experimentation we are unaware of their existence. Then, after the phenomenon is called to our attention, we are not conscious of the changes as they occur. Nevertheless, these fine changes in kin-aesthetic impulses are cues to our perception of distance.

In other words, we must accept these impulses as subliminal excitations which find their way by a process of 'seepage' into our consciousness. Any disturbance in these processes would rob us of our perception of distance. This being true, it is not unreasonable to deduce that any faulty or incorrect Oratans disturbs the speech mechanism in such a way as to make speech output difficult and hazardous.

It is therefore necessary that each step of this Orthenic material be mastered with thoroughness. This thoroughness means not only an exactitude when there is functioning a directive consciousness but when the process drops into the category of habit there should be a *residuum* (subliminal excitation) to give assurance and ease to subsequent articulation, preparing the musculature to assume the Oratans necessary for the proper production of the intended sound.

The material applies to the various types of speech defect. In cases of stammering and stuttering, so called, the procedure

may be followed with practically no deviation. In the case of infantile mutilation where the difficulty is encountered with Densants, Labriens, Linguadors, the words which contain those sounds should be particularly stressed, but all included.

The same applies to cases of cleft palate or pseudo-cleft palate (congenitally short or amputated uvula), that is, the Maxillaens and Linguadors, the particular source of trouble should be emphasized but all the exercises employed. The same applies to speech blockage and suspected amnesias. Twitmyer has successfully employed this method in a case of facial palsy and one of partial lingual paralysis.

The justification for practicing sounds not the cause of difficulty lends itself to a simple explanation. To begin with, all of us could profit by speech training. Few persons habitually articulate in a manner so precise that improvement would not be beneficial. For all of us who speak 'normally' the further perfection of articulation would be a luxury but in the case of individuals suffering speech defects, the least improvement in sounds ordinarily made with some degree of clarity is a necessity.

If one with a speech defect can improve those sounds which he can make even fairly well, it means 'notching up' the sum total of his entire speech output. But there is a psychologically more important phase to be considered. On the basis of apperceptive processes and the assurance and feeling of satisfaction and safety which comes from a complete mastery of a given number of sounds, the case can venture, fortified, to the newer and more troublesome sounds. Assuming the Oratans necessary, the subsequent sound becomes easier, more precise, and requires less conscious effort.

The correct and satisfactory articulation of a series of sounds makes way for a certain proprioceptive set (an integral part of the speech process). The ease of speech output thus effected avoids tension, strain and muscular enervation (false stimulation).

This suggests to us the profound problem of the transition which occurs mentally between the presentation of the symbol (the printed or written word) and the final meaning of the word. It would mean fundamentally greater comprehension if each time an individual saw or heard a given word, phrase or sentence, through surrogate imagery he could recall it kinaesthetically as well as in the visual or auditory modalities. It would make for greater economy and speed of reading and learning and would facilitate the acquisition of reading by young children in the earlier grades of school.

Speech is so inexplicably bound up with the type of thought processes that Twitmyer has often suggested the desirability of

a test which would determine the imaginal type of the individual. We encounter the fact that young children are more apt to be auditory or visual in their imaginal type than kinaesthetic while with the adult kinaesthesia plans the more important rôle. However, one does not usually find the individual adhering strictly to one type at the exclusion of the others. The visual, auditory and kinaesthetic modalities are further analyzed into the categories, verbal and concrete. Existing tests are restricted in their applicability because of the unreliability of the necessary introspective evidence. When the imaginal type has been accurately determined it can form an integral part of the training program. As in any other pedagogical project the specific major and minor imaginal types should be set in circumstances optimal for their exercise.

It is relatively absurd to expect a young child to become the recipient of the "sense data" of brownness, largeness, affectioness, livingness, etc., etc., the attributes one ordinarily ascribes to a dog from the abstract symbols—D-O-G. We are aware of the explanation commonly offered in terms of association to explain this phenomenon and accepting the applicability of these laws insists that strengthening the impression in additional modalities must effect greater facility in learning. Thus, if the child becomes immediately aware upon seeing the symbols D-O-G of the "sense data" which he has been taught and which he has experienced plus the muscular images of the tongue against the front teeth for the 'D' and the arched posterior tongue for the 'G,' he is more certain upon subsequent exposure to 'feel' and 'know' (in the sense of recognition as an element of memory) the symbols, the object, the "sense data" attributed to it. For now the child is utilizing a maximal number of imaginal types.

Thus for children in the first grades of school, when reading is being taught, a systematic instruction employing the progressive method made possible by this analysis of Orthenic material is urgently recommended.

Faulty Oratans is analogous in the mental make-up and speech production of children to an astigmatism or strabismus in their visual mechanism. Assuming that speech is an instinctive process and that most defects are a matter of functional rather than organic disturbance this method of presentation is a complete therapy. It has been suggested by some psychiatrists that where a pathological blockage actually occurs material such as this would permit of re-education (re-routing mental traffic, as they term it).

Because of the progressive presentation thus made possible there is afforded to the case the advantage of apperceptive processes. The case moves from the known to the newer. Thus

there is re-established more promptly that originally learned and it is used in the development of the more complex sounds.

The field of Orthenics is a most promising one. We differentiate man from animals on the basis of soul. Whether or not we accept this differentiation we may make one which offers more definite assurance, viz., that man and animal may be differentiated on the basis of thought process and its subsequent interpretation and transition through spoken language.

Man is the one member of the animal kingdom who talks for the sake of talking and derives enjoyment and fulfillment of his aims through the spoken word. Good speech, facility of expression, forcefulness of conversation are qualities without which one can enjoy success in only a limited number of human activities. It is important to the parent who would commune with his child.

There is in all science no phenomenon more marvelous or glorious to observe than the child's acquisition of speech. There is nothing more pathetic than its loss or impairment. The Orthenist's task is a noble one, with the proper method and application, the prognosis is hopeful. Orthenics is a science par excellence. To thousands of afflicted it holds forth promise of happiness and usefulness.

X—SUMMARY

1. Existing attacks upon the problem of speech correction are inadequate and unscientific.
2. Removal of immediate cause of speech defects does not mean restoration of normal speech.
3. Historical surveys emphasized unscientific and phantastic etiologies.
4. Hence Twitmyer approached the problem:
 - a) Bio-chemically
 - b) Physiologically
 - c) Psychologically
 - d) Pedagogically.
5. A study of the abnormalities of speech indicated the normal processes—the basis of Twitmyer's postulates:
 - a) Correct breathing and proper utilization of breath.
 - b) Correct kinaesthetic imagery (Oratans).
 - c) Combination of A and B in speech output.
6. To meet this approach appropriate material was needed.
7. A dichotomous classification of Libaers and Mutaers, with the latter divided into eight (8) groups was made independent

of traditional or philological classification but with anatomical correlation on the basis of the 'Curve of Articulation.'

8. Combinations of sounds were made, and

9. From various sources 5,138 frequency words were selected.

10. The general trend of frequency sounds was consistent with the 'Curve of Articulation' with the exception of L-R group accounted for pedagogically.

11. The use of frequency words is valid pedagogically and further indicated since between six (6) words representing 20% of spoken English and 1027 words representing 78.6%, the frequency list herein utilized would insure practiced articulation of probably 90 plus % of spoken English.

12. The completed scientific approach to the problem based on the 'Curve of Articulation' indicated the need for a progressive allocation of sounds and words.

13. The Orthenic material herein presented is applicable to all types of speech defect in which a prognosis could be favorable.

14. The system herein proposed takes into account imaginal types (stressing kinaesthesia).

15. On this basis it is recommended as a method in teaching reading to children and in the improvement of articulation where no specific abnormalities exist.

16. This system of Orthenics, emerging primarily from observations of 'teaching outcome' in the clinic has been validated conceptually and analytically.

17. In conclusion, we cannot over-emphasize what has been stated previously as the therapeutic scheme made possible by this basic analysis. Speech production is dependent on three processes: First, correct breathing; second, correct Oratans, and third, the combination of processes. If these three steps are superimposed on a mentality properly motivated and capable of thinking out material for expression and no pathologies exist in the neural or muscular mechanism, we may predict integrated speech.

